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AGRICULTURAL
Research

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International Cooperation

ARS research is playing a part in this nation's international relations, partly by helping others protect or increase food supplies. Here are a few examples:

Ten years ago, numerous countries in the Middle East and Africa were losing large amounts of food to heavy locust infestations. Iran had its heaviest outbreak in 80 years.

Today, as a result of modern U.S. pest-control methods, the historic locust plagues have been reduced to a point where only routine surveillance and control programs are needed to eliminate any new infestation. Literally millions of people are being fed from crops previously sacrificed to locusts.

Plant breeders are also providing heavily populated nations with ways to increase food production. Take, for example, pearl millet in India, grown there for food on 29 million acres. Indian officials agreed early last year to release a new hybrid throughout the entire millet area.

The new millet (HB–1) is a cross between an Indian inbred and Tift 23–A, an inbred developed at Tifton, Ga. HB–1 yielded 88 percent more grain in 2-year tests in India than the best local varieties.

Utilization scientists are working with developing countries to find new food-protein sources for areas short in meat, milk, and eggs. They are finding methods for processing high-protein flours from soybeans, cottonseed, and peanuts. Foods are then prepared that combine these flours with locally grown vegetables and cereals.

More often than not, research assistance given a foreign nation also benefits the United States.

By helping combat rinderpest in Africa, ARS scientists are paving the way for expansion of livestock production on that continent. They are also lessening the likelihood that the disease will spread accidentally to U.S. livestock. Since rinderpest resembles other livestock diseases, it might gain a foothold before being identified and eradicated.

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Orville L. Freeman, Secretary
U.S. Department of Agriculture

G. W. Irving, Jr., Administrator
Agricultural Research Service

MONITORING THE ENVIRONMENT

ARS announces results of pilot studies of areas in the United States where pesticides are used most intensively

■ ARS scientists have announced results of pilot monitoring of areas of the United States where pesticides are used most intensively. Results so far indicate—

- No progressive build-up of any great magnitude of organic pesticides in soil, sediment, and water in the Mississippi River Delta—an area with a long history of heavy pesticide use by farmers.
- Minimum side effects from Federal-State pest control programs.

ARS stepped up its pesticide monitoring work in 1964 when it established a pilot study in the Mississippi River Delta to monitor the impact of pesticides on the environment. At the same time, ARS strengthened its efforts to find out what effect Federal-State programs have had on the environment in several States.

These activities are part of a government-wide effort, which includes monitoring by the Departments of Agriculture, Defense, Interior, and Health, Education, and Welfare.

HEW's Food and Drug Administration, for example, makes "market basket" studies, in which it collects and analyzes food samples from grocery stores in three major cities. The most recent report of this study showed: (1) that pesticide levels found in test samples were generally less than one percent of the safe legal tolerance, and (2) that many of the most commonly used pesticides were not found at all in the samples.

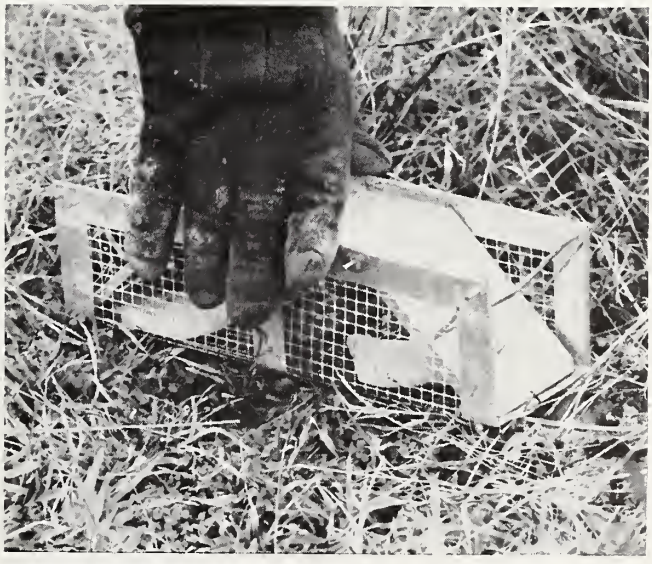
The ARS pilot study of the Mississippi Delta began in areas where farmers have generally used large amounts of pesticides for several years. The immediate goal: Determine existing pesticide levels from samples of soils, water, crops, livestock, and certain species of aquatic and land animals. Special attention is given to honey bees and other beneficial insects.

More than 3,000 samples were analyzed during the first year at the ARS monitoring laboratory, Gulfport, Miss.

The ARS investigators thus far have found no apparent large build-up of pesticides from year to year. Two pesticides used widely on cotton. DDT and endrin, have been recovered from cotton fields. The amount recovered was small, however, compared to the cumulative total of the pesticides used.

Soil samples taken from an area

More than 3,000 samples were analyzed during the first year in pilot monitoring of the Mississippi Delta. Levels of pesticide residue were determined in soils, water, crops, livestock, beneficial insects, and species of aquatic and land animals.



treated with DDT each year for 9 years, 1955–63, showed little progressive DDT build-up. The samples contained only about one-third of the DDT applied during a single season. Nor did samples of water or sediment from ponds and streams reveal any progressive build-up. DDT was detectable in water samples from this area during only one month, January, out of the nine months of pilot sampling in 1964.

In an area where 13 applications of endrin have been made on cotton each year since 1956, no residue build-up was found in soil and sediment. Minute quantities of endrin were detected in water during the control season.

Trace amounts of benzene hexachloride, aldrin, and dieldrin were also recovered from soil, sediment, and water—although appreciable amounts of these pesticides have not been used there for several years.

ARS monitoring activities were expanded to 55 test sites which include a national soils monitoring program, which was developed by the Federal Committee for Pest Control. The added sites, located throughout the United States, include forests, arid rangeland, plains, and Eastern hardwood, all areas where low amounts or no pesticides have been applied. The soils monitoring program, now in its pilot-study stage, is designed to explore the need for further monitoring activity in areas exposed to different levels of pesticide.

During 1964, various Federal and State agencies, including fish and wildlife and public health organizations, cooperated with ARS in monitoring Federal-State control programs against grasshoppers, cereal leaf beetles, boll weevils, Japanese beetles, witchweed, and gypsy moths. Here are some of the results:

- The Texas Parks and Wildlife Commission and the Texas Technological College cooperated with ARS in checking the effect in the High Plains of low volume malathion against boll weevils. Conclusions: Fish and wildlife suffered no injury; and although the treatments depressed populations of beneficial insects in cotton fields, the depressing effect was not significant.
- The Michigan State Departments of Conservation and Agriculture cooperated with ARS in monitoring the effect of low volume malathion against cereal leaf beetles. Conclusion: The treatment had no harmful effect on wildlife.
- The U.S. Fish and Wildlife Service and Nebraska State Department of Agriculture cooperated with ARS in monitoring the effect of low volume malathion against grasshoppers in Sioux County, Nebraska. Conclusions: Direct effects on wildlife appeared to be slight; small animals apparently were unaffected. There was some movement of birds off the treated area; and the level of blood cholinesterase apparently was lowered in both wild turkeys and domestic turkeys caged under the spray. The effect was not believed significant, however.
- Michigan State University and ARS cooperated in monitoring the effects of dieldrin used in 1963–64 against Japanese beetles in the Battle Creek, Mich., area. Conclusions: Dieldrin residues were present in soil samples but not in water; and they existed at low levels or were absent from silt from stream beds or ponds.☆

How Do Implanted Spirals Stop Animal Reproduction?

■ One of the most intriguing puzzles in animal reproduction today involves a small plastic spiral called intrauterine device (IUD).

In several mammals, the plastic spiral prevents reproduction when properly placed in the uterus. However, the stage at which reproduction is halted differs from one species of animal to another, and this complicates the task of answering the basic question: Precisely how do IUD's work?

Led by H. W. Hawk, ARS animal physiologists have just completed a study in which spirals were placed in the uterus of ewes. The research showed that IUD's interfere with the mechanism that carries sperm to the oviduct to fertilize the eggs.

The experiment on ewes is part of an extensive international study of basic reproductive principles. The mode of action of IUD's is still un-

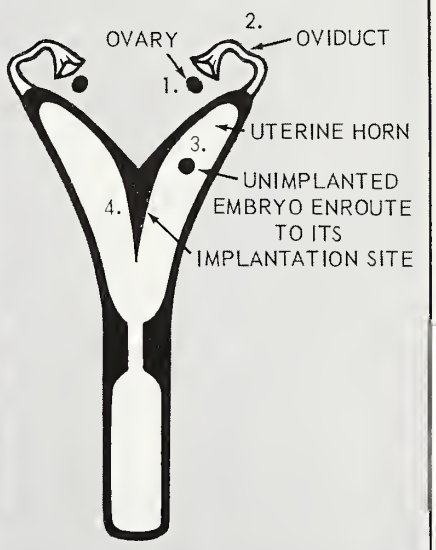
Plastic spirals (IUD's) affect animals in different ways. The diagram and text contrast major stages normally leading to pregnancy with what actually happens in each of six animals.

1. Ovary normally sheds egg. (IUD stops egg production in WATER BUFFALOES.)

2. Egg normally travels into oviduct where it is fertilized by sperm. (IUD interferes with sperm transporting mechanism in EWES, and it often prevents union of sperm and egg in COWS.)

3. Fertilized egg normally starts dividing, becomes known as "embryo," and implants in wall of uterus. (IUD blocks embryo implantation in SOWS and RATS.)

4. Implanted embryo normally continues development. (IUD causes embryo to degenerate in RABBITS.)



Test animals react differently, say ARS animal physiologists, who studied ewes, cows, and sows

clear. Further clarification may give clues to reducing reproductive losses in all classes of livestock—one of the major roadblocks to profitable livestock production. Related ARS studies currently include research with sows and cows, as well as ewes.

For the recently completed sheep trial, ARS physiologists implanted IUD's in two groups of ewes and then removed the devices immediately from one group. Afterwards, both groups ovulated as usual, and eggs were found at the expected places in the reproductive tract. This indicates that eggs traveled through the tract at the usual rate.

As a next step, eggs were transferred from treated ewes to the oviducts of normal, mated ewes to see whether eggs shed by IUD-treated ewes have the potential to be fertilized by sperm. Two days later, scientists found that transferred eggs had become normal embryos, which is evidence of successful fertilization.

Sperm have to travel from one end of the reproductive tract almost to the other to fertilize an egg. Hawk flushed out the entire tract of mated IUD-treated and normal ewes to check on sperm travel. He found no sperm had reached oviducts of ewes implanted with IUD's, while thousands appeared in the oviducts of untreated ewes.

Furthermore, he discovered dozens of sperm stuck in the outer membranes of eggs in unflushed oviducts of ewes without IUD's—although only one sperm fertilized each egg. No sperm were found in the outer membranes of eggs from IUD-treated ewes, showing clearly that the sperm from these animals didn't make the usual trip through the reproductive tract.

Like most domesticated mammals, ewes have a uterus that is divided into two uterine horns. Surprisingly, when Hawk implanted an IUD in one horn but not the other, eggs shed by both ovaries remained unfertilized—on the untreated as well as the treated side. No sperm were found by flushing oviducts opposite the implanted horn.

This situation contrasts with findings in cattle. When only one horn of a cow's uterus is implanted, the egg on the opposite side can be fertilized, and it can then develop into a normal fetus.

Since sperm in ewes won't travel even through the uterine horn opposite the site of the implanted spiral, it is evident that the IUD is more than just a physical road block. The entire sperm-transporting mechanism must be put out of order by the device. ARS physiologists are now trying to find out why.☆

MINIATURE HOGS

New guinea pigs for FDA drug testing

■ A new type of research animal is being developed jointly by ARS and Food and Drug Administration scientists at Beltsville, Md., for use in FDA's drug testing program.

Although the animal—a white hog—is the same species that has been banging feeder lids on thousands of American farms, it is only about one-third the usual size.

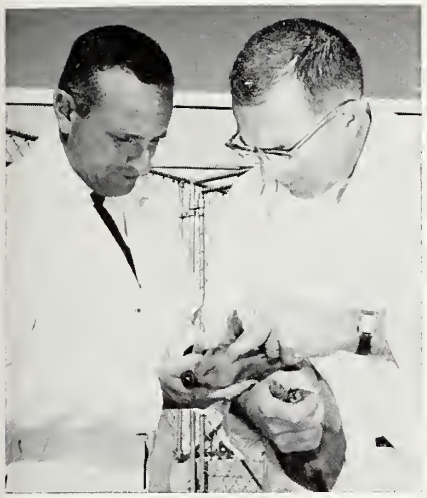
Why a hog? FDA veterinary toxicologist F. L. Earl explains that hogs are physiologically more like humans than other nonprimates, and they are subject to many of the same maladies. Hogs have, for example, similar requirements for food, and they digest it in much the same way. They also suffer from peptic ulcers. A hog's heart and major blood vessels are much like ours—and the animal can get atherosclerosis (a form of arteriosclerosis, hardening of the arteries, caused by the deposit of fat).

But there is a big drawback to using commercial breeds of hogs for testing drugs: The animals grow too large. And big hogs not only require large doses of costly experimental drugs, they also are expensive to house and difficult to handle.

"For every trial, we administer doses of drugs to about 30 hogs for 6 months," Earl explains. "If you can imagine having to face hostile boars as heavy as 600 pounds, you can appreciate the advantages of using our small hogs."

Miniature hogs were first bred at the Hormel Institute of the University of Minnesota 16 years ago. Starting with various wild and semidomesticated strains, researchers developed hogs that are genetically limited—from birth to maturity—to about one-

Miniature hog (Hanford x Hormel) is about a third the weight of female of mixed breeding. Both are 7 months old. (Erect hair along backline of the miniature makes it look larger than it actually is.)



ARS geneticist Taylor and FDA veterinary toxicologist Earl check the eyes of one of the miniature pigs at the Beltsville FDA laboratory. Hogs make good test animals because they are physiologically more like humans than other nonprimates.

third the size of those most commonly bred on farms.

The Beltsville miniature herd was started 2 years ago with special attention to breeding white-skinned animals. Some people break out with a skin rash much like measles when they take antibiotics, and a white-skinned hog will help identify drugs that cause these side effects.

J. C. Taylor, ARS geneticist in charge of the project, says that learning how selection for small size affects such economically important hog traits as reproductive performance, litter size, body conformation, and deposition of tissue should add to the store of basic genetic information. ARS scientists also plan to explore the possibility of using miniature hogs in basic nutrition, physiology, and biochemistry research.

For farmers, miniature hogs offer a way to increase income by raising research animals on contract for investigators at thousands of research, testing, and assaying laboratories throughout the country. Earl says he knows of only two commercial sources that supply miniature hogs at present—and they can't fill his needs.

The National Academy of Science reports that research animals in general are a $2.9 million market today; other informed sources say this market will rise to $6 million by 1970.

Animal husbandry specialists foresee the day when strains of sheep, cattle, and poultry also might be developed for biological research. Scientists would need to establish techniques by which farmers could care for and maintain these animals to suit the needs of biological laboratories.☆

Breeding Plans Needn't Change . . .

When Altering Dairy Management

■ Dairy farmers needn't change a herd's breeding plan when switching from one ration to another. This assurance is given by ARS scientists who conducted comparative studies on herds in Utah and Tennessee.

Project coordinator R. D. Plowman, an ARS dairy management and breeding specialist at Beltsville, Md., says the studies also revalidate the practice of artificially inseminating herds with bulls raised in distant States under dissimilar management. These sires are as capable of upgrading the herd as nearby bulls with the same superiority rating.

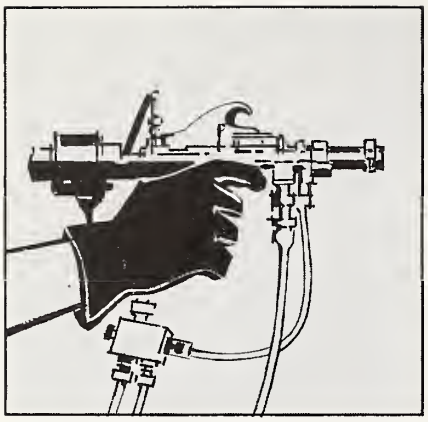
ARS dairy specialists R. C. Lamb, working with Holsteins in Utah, and J. R. Owen, using Jerseys in Tennessee, managed the two participating herds, with cooperation of the Agricultural Experiment Stations of these two States.

For the trials, 14 Holstein and 13 Jersey bulls were mated to groups of cows averaging approximately the same milk yield. The sires, belonging to various blood lines, were proved in widely separated parts of the country.

Half the daughters from each sire received only a roughage ration—as much as they wanted. The other half also received grain in proportion to milk yield. The 189 Utah Holsteins were given alfalfa hay and the 205 Tennessee Jerseys alfalfa hay and silage. Holsteins were fed a pound of grain for every 3½ pounds of milk and Jerseys, a pound of grain for each 3 pounds of milk.

The cows receiving grain outproduced their half-sisters given roughage only, no matter which bull sired them. And, as expected, some bulls had daughters on roughage only and on supplemented rations which outproduced daughters of other bulls.

However, when the scientists ranked bulls separately on the basis of performance of daughters given roughage only and those receiving added concentrates, the rankings were in nearly the same order. Statistical analysis confirmed that, on the average, daughters of superior sires were better milk producers, regardless of what system was used to feed the daughters or where the bull was raised and proved.☆



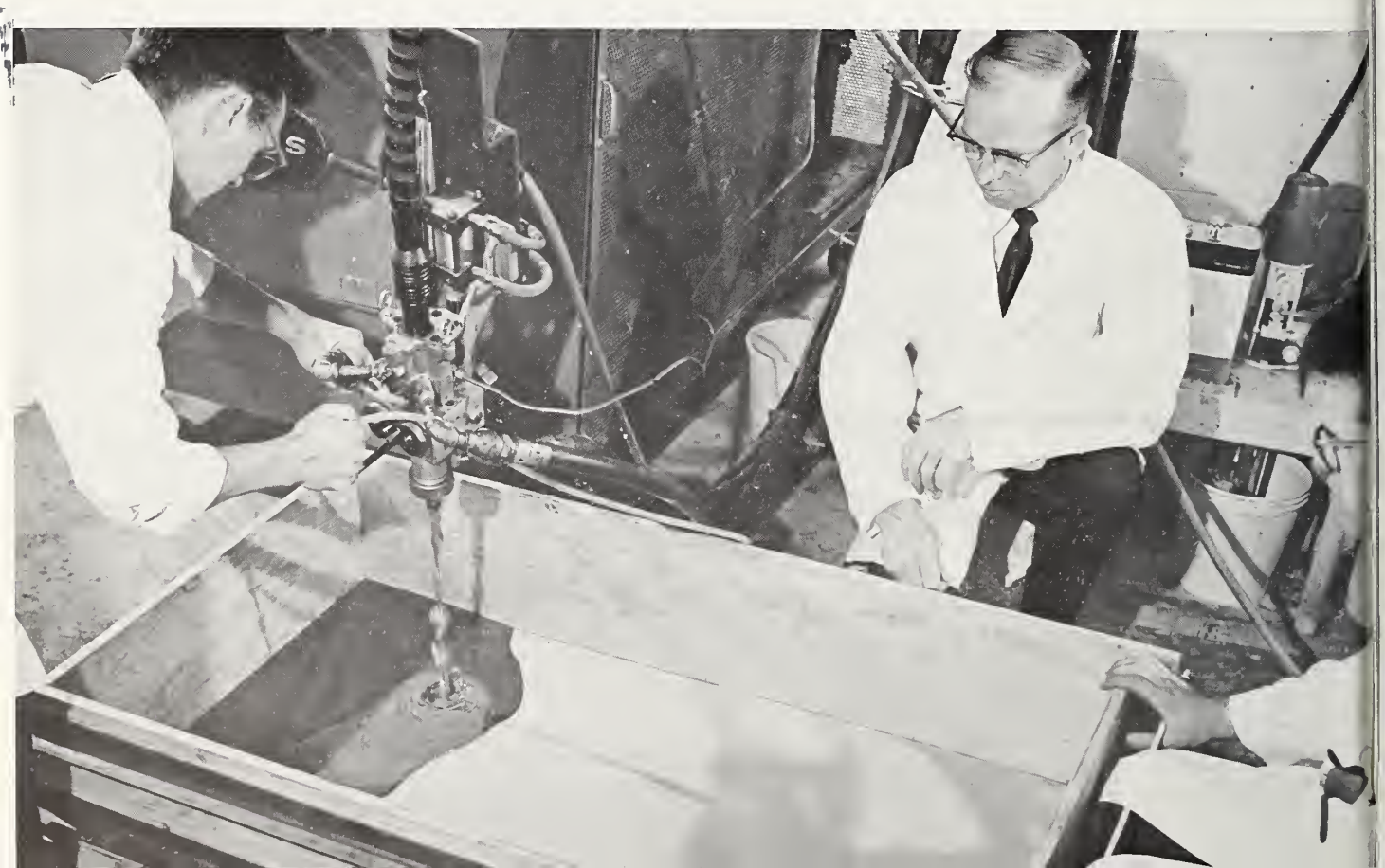
Utilizing starch from corn, lightweight foam can be poured or used as a . . .

SPRAY-ON INSULATION

■ The starch from a single bushel of corn can be used to make enough polyether for an inch-thick layer of lightweight foam that, when dry, will insulate the exterior walls of a 50- by 25-foot home.

Developed originally in 1963 by ARS utilization scientists, starch-based polyether is an industrial raw material that utilizes a major farm commodity. Sprayed in place as a foam—around pipes and between wall studding, for example—it adheres to most any surface and immediately dries as a rigid layer of insulation molded to the contour of the surface.

Commercial urethane foams—which made thin-wall refrigerators possible—are now finding broad outlets for insulating dwellings, buildings, freezers, and refrigerated trucks and tank cars. Rigid urethane foam is also used for buoyancy in boats, buoys, and life preservers. Commercial production is expected to reach 100 million pounds annually by 1968.



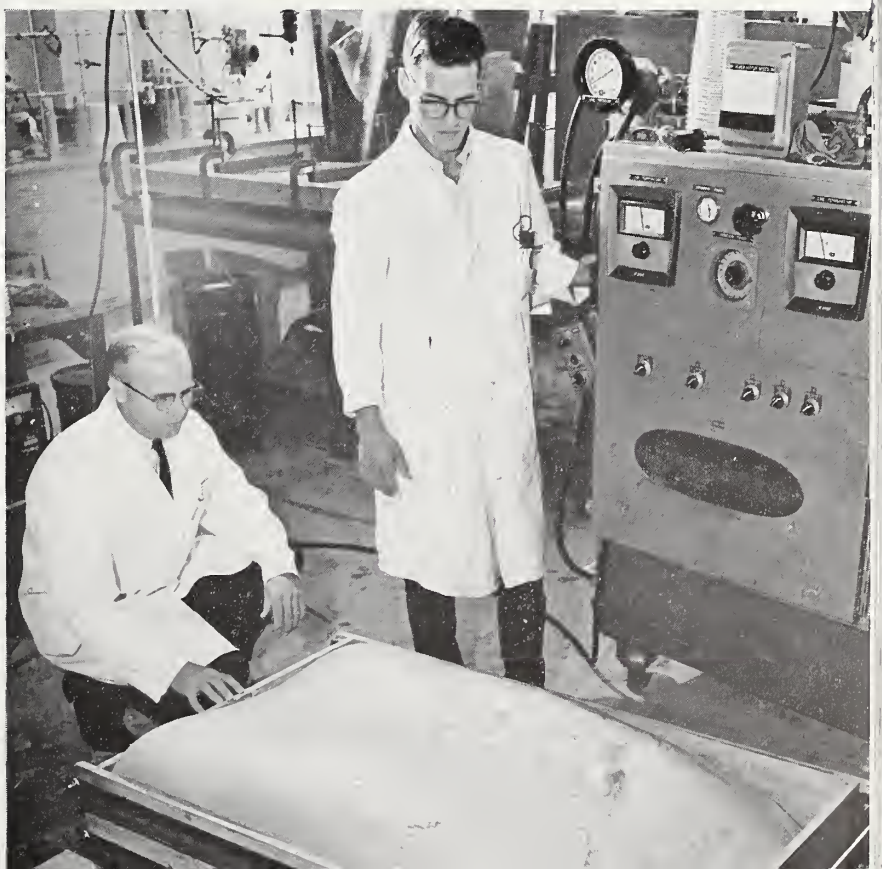
Archer Daniels Midland Co. of Minneapolis, working under contract with ARS, recently conducted studies showing that the starch-based polyether can be made for about 15 cents a pound in a plant producing 10 million pounds a year. This amount of polyether would use the starch from 100,000 bushels of corn.

The contract studies dealt with processing conditions and cost of producing polyethers, preparing foams on a continuous-operation machine, and evaluating the foams.

The contract scientists made starch-based polyethers in experimental lots as large as 1,000 pounds, which were then mixed with a cross-linking agent to make the urethane foam at a rate of 45 to 50 pounds a minute.

The improved product has the added advantage of requiring less of the expensive cross-linking agent, and it does not need viscosity modifiers to improve flow properties. The starch-based foam has flame and humidity resistance and strength that compares favorably with commercially available foams.

Starch-based polyethers were first made and converted to foams on a laboratory scale three years ago by chemists F. H. Otey, B. L. Zagoren, and C. L. Mehltretter at the Northern utilization research laboratory, Peoria, Ill. They first reacted starch with ethylene glycol (commonly used in antifreeze) to make glycosides and then reacted the glycosides with propylene oxide to make the polyethers.☆



Scientists pour urethane foam at a rate of 45 to 50 pounds per minute (left) in tests with new, starch-based polyethers developed at the Peoria laboratory. The resulting test "buns" (right) are used in evaluating different formulations of foam insulation.

In mass rearing insects for studies at Tifton, Ga., an entomologist finds a way to . . .

Cup and Cap Them AUTOMATICALLY

■ In the war against insect pests, scientists are often hindered by the problem of rearing the great numbers of insects needed in studies such as those on male insect sterility and on insect pathogens, attractants, and repellents.

Especially difficult is the problem of mass rearing pests that tend to be cannibalistic and must, therefore, be reared individually.

Automation has provided at least part of the answer for ARS entomologist R. L. Burton at the Southern Grain Insects Research Laboratory, Tifton, Ga. Approximately 500,000 insects per year are reared there in studies to find new methods of controlling grain pests.

Burton has devised an improved technique for rearing fall army worms that turns out insects "untouched by human hands."

This means that formerly tedious and time-consuming hand tasks—setting out rearing cups, filling them with insect food, placing a larva inside each cup, and capping the cups—are now done automatically.

Burton expects the unit will prove equally useful with the difficult-to-rear corn earworm, as well as other insects.

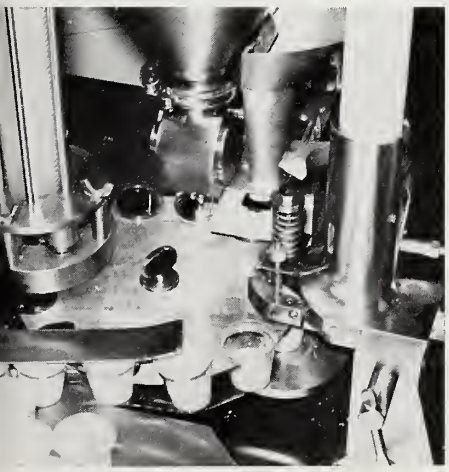
The heart of the new procedure is a modified version of a machine used in large restaurants for filling small

cups with jelly or salad dressing. Burton fills the well of the machine with insect food and the machine automatically moves prestacked plastic cups into position and fills them with the food. Burton modified the cup filler by adding a device that drops larvae into each cup, which then moves on to be capped. The larvae are then ready for incubation in the rearing room until they complete their growth.

With the old process, dispensing 3,000 cups, filling them with food and larvae, and capping them would take about 13 man-hours. One person operating the machine can perform all these tasks in 1 hour.☆

Technician Marcy Latham and entomologist Burton cup insects. The completed cups, ready for incubation, are placed in trays (left).

Empty cups (below) are dispensed into rotating wheel, and artificial insect diet and one larva are automatically placed in each cup. The cups are then capped and ready for incubation.



Developed for U.S. servicemen in Viet Nam

An Effective Leech Repellent

■ ARS entomologists have developed a leech repellent that has proved effective in field tests made by the U.S. Army in jungle areas of the Philippines.

The repellent is expected to be made available to military forces in Viet Nam for protection against both water and land leeches. It can be applied either to the skin or to clothing.

The Army requested assistance in developing the repellent because of the extensive research ARS has conducted on insect repellents. ARS entomologists H. K. Gouck and John Taylor performed the studies at Gainesville, Fla., with funds supplied by the Limited War Laboratory of the Department of Defense.

Leeches attach themselves to a person's skin and then inflict a Y-shaped wound into which they inject an anticoagulant material. Leeches suck blood and cause bleeding but are not associated with transmission of disease.

The ARS entomologists conducted 135 laboratory tests with about 50 different chemicals, before settling on a repellent consisting of 25 percent Deet and 75 percent lanolin. Deet (N-N-Diethyl-*m*-toluamide) is a widely used insect repellent developed a few years ago in ARS research. The lanolin holds the Deet to the skin or on the clothing and prevents it from being easily washed off. Lanolin also is somewhat repellent in that it makes it more difficult for the leech to become attached to the skin.

The Deet-lanolin mixture proved highly effective, first against American and Korean leeches brought to the Gainesville laboratory, then in field tests conducted in the Philippines.☆

Scientists study cold-water detergents and disinfectants, conduct laundering experiments to answer housewives' question . . .

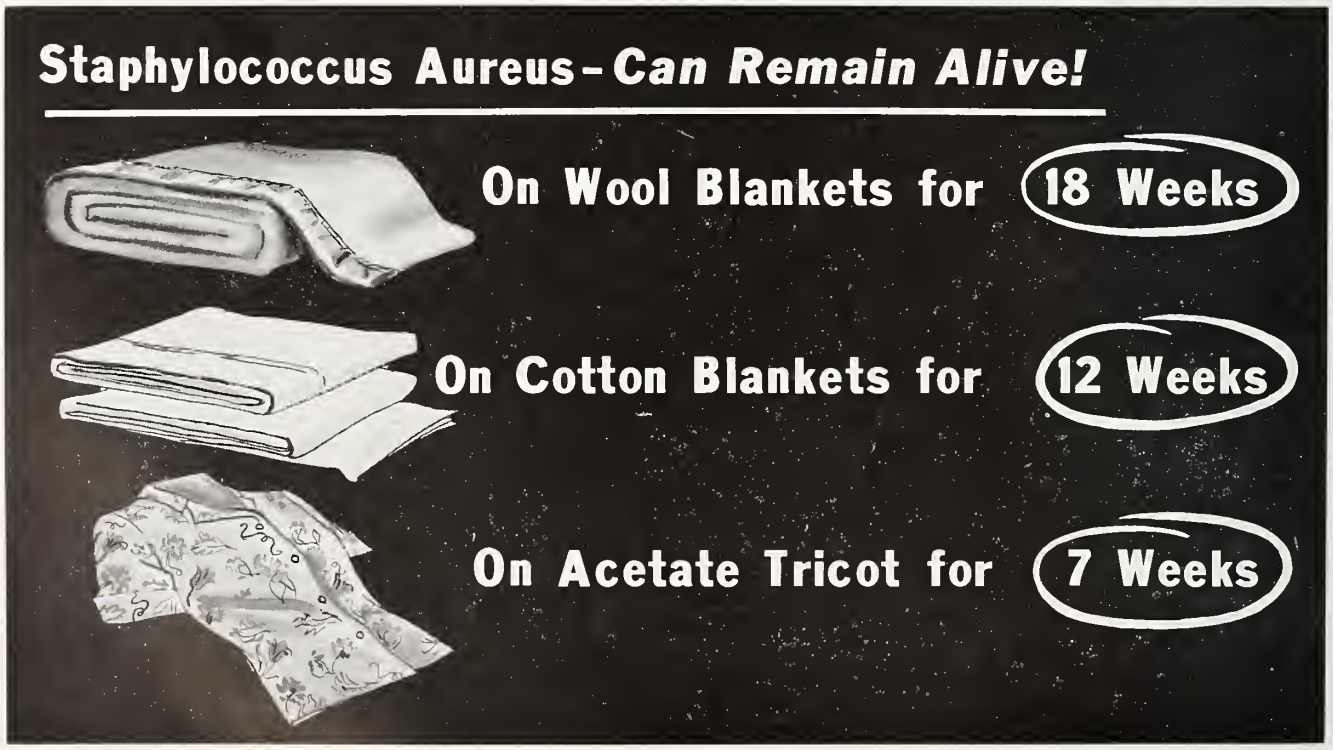
What About Bacteria in Cold-Water Laundering?

TEMPERATURE	DISINFECTANT	AVERAGE NO. BACTERIA PER SQUARE INCH OF FABRIC FAMILY 1	FAMILY 2
HOT	NONE	2,275	1,650
COLD	NONE	9,100	20,284
HOT	CHLORINE	UNDER 25	25
COLD	CHLORINE	25	UNDER 25
HOT	QUATERNARY	25	40
COLD	QUATERNARY	25	25
HOT	PHENOLIC	40	50
COLD	PHENOLIC	15,010	80,605
HOT	PINE OIL	45	75
COLD	PINE OIL	9,280	11,245

■ Since cold-water detergents first appeared on the market, housewives have been asking: What happens to bacteria in laundry washed in cold water with a cold-water detergent?

To find the answer, an ARS re-

Just how water temperature and disinfectants affect bacteria survival in home laundering is shown in the accompanying table. The research team took bacteria samples from a sterile swatch attached to each soiled article. Water temperatures ranged from 57° F. to 64° F. during cold-water laundering and from 122° F. to 140° F. during hot-water laundering.



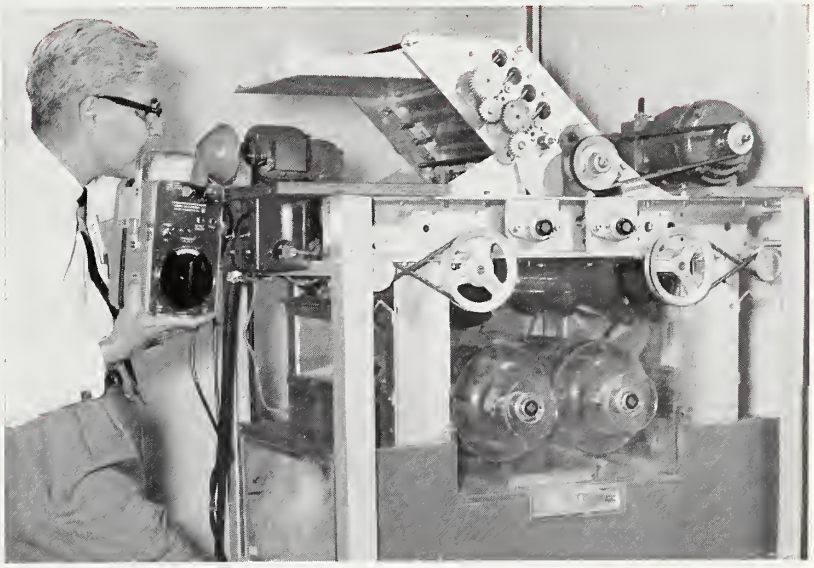
search team led by textile bacteriologist Ethel McNeil undertook some exploratory experiments as part of a long-term study of bacteria that survive home-type laundering. Earlier work had indicated that large numbers of bacteria were able to survive both hot- and warm-water laundering when a detergent without a disinfectant was used. Adding a suitable disinfectant reduced the bacteria count to a safe level.

In the light of these findings, the bacteriologists carried out experiments at lower water temperatures. A cold-water detergent was used, both alone and in combination with each of four types of disinfectants, to wash laundry from two families of laboratory personnel. All disinfectants were used at levels found most effective in the earlier studies at hot water temperatures.

When the research team used a detergent with no disinfectant, appreciably more bacteria survived cold-water washes than survived hot-water washes. In the case of one family, the average number of bacteria per square inch of fabric ranged from 20,284 for cold-water washes to only 1,650 for hot-water washes (see table).

When the scientists added an appropriate amount of chlorine disfectant in the wash cycle, or quaternary disinfectant in the rinse cycle, however, the number of bacteria were reduced substantially. Both of these methods cut the bacteria count to 40 or less per square inch of fabric at the end of the spin-dry cycle—regardless of water temperature.

On the other hand, when laundry was washed in cold water with a cold-water detergent, the addition of phenolic or pine oil disinfectant in the wash cycle was relatively ineffective in reducing the bacteria level.☆



Using an electronic tachometer, research engineer Mayer, checks roller speed of the experimental fiber separator's feed mechanism.

Improving Cotton Yarn

■ Consumers can expect higher quality cotton products if an experimental machine developed by ARS scientists proves economically feasible. The machine, now being tested at the Southern utilization research laboratory in New Orleans, uses an electrical field to remove quality-lowering short fibers from cotton before spinning.

What the high-voltage electrical field actually accomplishes is the separation of cotton fibers of different lengths. The electrical field, created between revolving cylinders, makes individual fibers stand erect.

The fibers are then moved by mechanical means; a nonconducting plastic arm gathers the long fibers and moves them to the next processing step, while the short fibers are shunted to a disposal container as waste. The bench-scale-model machine has removed 20 to 45 percent of the short fibers from cotton tested.

Short fibers occur in all cottons and play no part in holding a yarn together. They prevent long fibers from lying snugly together, creating weakspots in the yarn.

Previous research at the New Orleans laboratory showed that for each 1-percent increase in short fibers (three-eighths inch or less) there is a 1-percent decrease in yarn strength. This decrease in strength causes a corresponding reduction in yarn uniformity, appearance, and value.

Most cottons contain between 5 and 12 percent of short fibers. As the short-fiber content approaches 10 percent, spinning of high-quality yarn becomes troublesome and expensive because yarn breakage demands increased attention from skilled personnel.

Developers of the experimental model—engineers Mayer Mayer, Jr., and J. L. Lafranca, Jr., and physicist H. W. Weller, Jr.—are now working to increase production rate and to reduce the loss of long fibers.☆

Chemists Ikemiya and Deobald check the potency of a sample of sweetpotato alpha-amylase.

Utilization scientists discover an enzyme in sweetpotatoes that will be used in food processing

Found: A New Food Enzyme

■ A new enzyme has been discovered by ARS chemists while working with sweetpotatoes at the Southern utilization research laboratory in New Orleans.

As a result, changes will be made in the process for making instant sweetpotato flakes to take advantage of the unique properties of the enzyme, an alpha-amylase. Industry may also find uses for the alpha-amylase in processing cereals, for example, and in fermentation techniques. But before this can happen, more must be learned about the enzyme, and a practical method must be developed to isolate it in pure form.

Although the enzyme helps in the process of converting starch to sugars, it is active at higher temperatures than most similar enzymes.

In limited studies, discoverers Masayuki Ikemiya and H. J. Deobald have learned much about the properties of the enzyme. One of its most interesting characteristics, for example, is that the enzyme is very active at 75 to 78° C., a temperature range that would destroy most other alpha-amylase enzymes.

At temperatures of 30° C. and 45° C., the enzyme has an acid tolerance substantially greater than that of most alpha-amylases, appearing quite stable at an acidity as low as pH 4. At these same temperatures, it also appears stable up to as high as pH 8, about as alkaline an agent as one would expect to use. The pH range narrows as the temperature is increased, until 80° C. is reached. Maximum activity occurs only at pH 6.

The newly discovered amylase, found in small amounts in freshly dug sweetpotatoes, builds up during storage. This explains a fact known to sweetpotato processors for many years—that sweetpotatoes can be kept firm during the canning process only if they are canned shortly after harvest. The enzyme builds up during even short periods of storage and, activated by the heat of processing, helps convert some of the starch to sugars. This makes the sweetpotatoes too soft for a top-quality canned product.

Conversely, in the manufacture of instant sweetpotato flakes, the presence of alpha-amylase is desirable, since it converts some of the starch to sugars. Changes therefore will be made in the flaking process, developed originally under Deobald's leadership, to use the enzyme's activity to the fullest extent possible.☆

AGRISEARCH NOTES

Test herbicide stops cattle deaths

Cattle deaths caused by whorled milkweed on ARS experimental ranges near Las Cruces, N. Mex., stopped after scientists treated the poisonous plants with a mixture of 2,4,5-T (ester), diesel oil, and water.

Range superintendent F. N. Ares began studies on whorled milkweed (*Asceplias subverticillata*) after finding that the plant was responsible for 19 of 23 cattle deaths on the ARS Jornada range in 1961, and for 38 of 41 deaths in 1962. Treatment with the herbicide reduced losses in 1963 to one certain and one suspect; there have been no losses the past 2 years.

Whorled milkweed is a dark, lustrous-green plant with a cluster of white flowers. A perennial having underground root stocks, it is found at varying elevations in semidesert areas of New Mexico, Texas, Oklahoma, west Kansas, Nebraska, Colorado, and Arizona. Cattle eating the plant lose muscular control, have difficulty breathing, and suffer violent convulsions. Death may follow almost immediately or within a few hours after symptoms appear.

Ares sprayed individual plant colonies to the point of drip with a solution of 20 gallons of diesel oil, an emulsifiable formative containing 6.8 pounds of 2,4,5-trichlorophenoxyacetic acid (ester), and 300 gallons of water. Sprayings were made monthly during the summer—when whorled milkweed grows best—by using a power sprayer mounted on a small trailer.

Milkweed colonies on the experimental range were scattered over four pastures totaling 29,059 acres. Costs for herbicide, labor, and transportation averaged $170 per spraying.

Ares points out that although the mixture—which is recommended for use by ranchers—controls top growth well enough to prevent cattle losses, repeated treatment is necessary because the roots continue to produce new surface growth.

Limestone boosts tomato yields

Adding dolomitic limestone to recently cleared Georgia Coastal Plain soils greatly increased yield of marketable tomato transplants—as much as 194,000 plants per acre in ARS tests in southern Georgia.

Most tomato seedlings transplanted in Northern States are grown in an area near Tifton, but until now the producers have been hampered by the large number of culls. The average yield of marketable plants has been only about 100.000 per acre—much below the land's potential.

Transplants are grown on land cleared of pine trees because these soils are relatively free of tomato disease organisms and nematodes. But this land is highly acid and deficient in calcium and magnesium. High acidity contributes to manganese poisoning, further limiting tomato plant growth.

ARS vegetable crops specialist C. A. Jaworski, in cooperation with the Georgia Agricultural Experiment Station, found that when he applied 2,000 pounds of dolomitic limestone per acre both the acidity and the nutrient-deficiency problems were corrected.

The 2,000 pounds of limestone, applied to test plots just before seeding, produced from 70,000 to 194,000

more plants per acre than were yielded by control plots where no limestone was added. About 1,050,000 viable seeds were planted per acre.

Limestone treatment also aids mechanical harvesting of tomato seedlings by reducing the percentage of culls.

Critical 14th day for unborn lambs

The poisonous weed false helebore causes malformed "monkey-faced" lambs only if the weed (*Veratrum californicum*) is eaten on the 14th day of gestation. If a ewe eats the plant before or after this day, the unborn lamb may be killed, but it won't be deformed.

ARS research on this weed proves that unborn lambs can be harmed by natural foods eaten by their dams when the fetus is at a critical stage of development. Although larger amounts of *V. californicum* can poison the ewe, small amounts eaten at the critical time can poison the fetus without affecting the ewe. (See "Monkey-Faced Lambs," AGR. RES., August 1964, p. 13.)

An experiment by ARS scientists

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AGRISEARCH NOTES

at Logan, Utah, and Ames, Iowa, pinpointed the time toxins in the weed injure unborn lambs. No malformed fetuses were obtained from ewes fed the plant on their 11th, 12th, 13th, 15th, or 16th day of gestation. Of 14 ewes fed the plant on the 14th day,

though, 13 had malformed fetuses and 1 contained a deformed dead embryo. Deaths of normal embryos occurred in two ewes that were fed the plant on the 11th and 12th day, one ewe fed the plant on the 13th day, and one ewe fed the plant on the 15th day.

The length of the susceptible period on the 14th day has not been determined, but it could be as short as 6 to 8 hours. In many cases of twin lambs from ewes that had eaten the weed, one is born normal and the other severely deformed. Probably only one is affected because the two fetuses develop at different rates and one fetus was not at the critical stage of development when the poisons were present.

On the 14th day of gestation, the lamb embryo begins to form different tissues, such as the neural plate, which later becomes the central nervous system. Rapid development of these early tissues creates the new organs and organ systems, including the eyes, nose, and mouth—the same organs that become malformed because of the plant poisons.

Studies of the poisonous range weed show that the toxic agents in this plant are contained throughout the plant—in the leaves, stems, and roots. As the leaves and stems lose their green color because of maturity, insufficient water, or freezing, they also lose the toxins. It is not yet known if the toxins are translocated to the roots or inactivated. But the roots consistently have been 5 to 10 times more toxic than the leaves and stems.

The scientists have also found that the quantity of toxins in this weed varies widely between range areas and also between plants in the same area from year to year.

New ARS pioneering research lab

Learning how plants resist disease will be the goal of basic research at a new ARS Pioneering Research Laboratory on the Nature of Disease Resistance in Plants.

Scientists at this new laboratory, located on the campus of the University of Wisconsin at Madison, will seek an understanding of how disease organisms such as bacteria and fungi attack plants, and how some plants are able to resist infection.

Results of these studies are expected to aid plant breeders in speeding development of resistant varieties.

R. D. Durbin, ARS plant pathologist, will be in charge of the laboratory. He will be joined by Arthur Kelman, chairman of the University's Department of Plant Pathology, in developing the laboratory's research program.

When fully staffed, the laboratory will have four senior scientists—Durbin, two biochemists and one plant physiologist—plus several research and graduate assistants. This staff will work closely with University plant pathologists.

USDA has 23 other pioneering research laboratories to help meet the need for basic research in specific areas. The pioneering investigations, begun in 1957, are part of USDA's regular program of basic research, which includes studies to obtain new knowledge needed to solve recognized agricultural problems.

CAUTION: In using pesticides discussed in this publication, follow directions and heed precautions on pesticide labels. Be particularly careful where there is danger to wildlife or possible contamination of water supplies.

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